



## Seattle-King County EMS

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# CBT/OTEP 620 **Infectious Disease**

print version of EMS Online Course  
[www.emsonline.net](http://www.emsonline.net)

## Infectious Disease

# Introduction

The world is a different place than it was several years ago. The events of September 11 have brought a global awareness of infectious diseases as agents of terrorism and war. In addition to the threat of terrorism, we are changing the natural world more quickly than ever in our history. Global warming, habitat destruction, even the widespread use of pesticides and herbicides are eliminating some species and favoring others.

The result? Diseases like malaria, a mosquito-borne illness, are moving northward into areas where they have never been found before. Association of some animals, such as scavenger crows, rats, and others, with human populations increases the chances of disease transmission from one species to another.

Given this worldwide concern about infectious diseases, how can you-as an EMS provider and a citizen-recognize infectious disease, treat your patients properly, and keep yourself safe? This course deals with these topics.

### Before You Begin

This is a continuing education and recertification course for EMS providers. It covers fundamental basic concepts and terminology as well as advanced material. We highly recommend completing the case studies and practice exam before completing the exam.

### Practical Skills

There is no practical skills assessment for this course. The best way to demonstrate knowledge of the material is to be vigilant in taking body substance isolation precautions on every call. A practical skills checklist is available that allows documentation of your agency's annual exposure control plan.

### Acknowledgements

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### Course Objectives

After completing this module you will be able to:

1. Identify the differences between bacteria and viruses.
2. Identify characteristics of inf. diseases that are a threat to EMS providers.
3. Identify appropriate measures for protecting yourself against inf. diseases.
4. Identify the appropriate actions to take for exposure to an infectious disease.
5. Distinguish between the infectious diseases EMS providers can encounter.

## Infectious Disease

# Terms

**antibodies** - Proteins made by the immune system that have a memory for an invading virus and help recognize and destroy future invasions by that virus.

**antibiotic** - Medicine or drug that is effective in killing bacteria or inhibiting their growth.

**bacteria** - A single-celled, microscopic organism that can cause damage to the body's cells. They multiply very quickly by dividing.

**epidemic** - An outbreak of a contagious disease that spreads among many individuals in an area or a population at the same time.

**pandemic** - An outbreak of a contagious disease that affects an entire population over a wide geographical area. A pandemic affects a far higher number of people and a much larger region than an epidemic.

**parasite** - An organism that grows, feeds, and is sheltered on or in a different organism while contributing nothing to the survival of its host.

**pathogen** - An agent that causes disease such as a bacterium, virus or fungus.

**vaccine** - A preparation of a weakened or disabled virus that stimulates antibody production and provides immunity when injected into the body.

**virus** - A very small agent made of genetic information (RNA or DNA) surrounded by a protein coat. It cannot reproduce on its own but must take over a living cell to multiply.

## Infectious Disease

# Resources

### Centers for Disease Control

Good search engine for accessing a wide range of infectious disease information.

<http://www.cdc.gov/>

### National Institutes of Health

Contains an information index that will help you to find the institution responsible for the subject of your choice. The Health Information Page will also supply you with a link to that institute's home page.

<http://www.nih.gov/>

### HIV InSite

Gateway to AIDS knowledge. Links to a variety of peer-reviewed articles on HIV infection, many statistics.

<http://hivinsite.ucsf.edu/>

### Pandemic Flu

Detailed information about influenza pandemics

<http://www.pandemicflu.gov/>

### Public Health - Seattle and King County Web Site

Information on issues affecting EMS providers in King County.

<http://www.metrokc.gov/health/providers/index.htm>

### Recommended Reading

Desowitz, R., **New Guinea Tapeworms and Jewish Grandmothers**. 1981. The American Museum of Natural History, NY.

Entertaining short stories dealing with parasitic diseases ranging from malaria to African sleeping sickness.

Garrett, L. **The Coming Plague - Newly Emerging Diseases in a World Out of Balance**. 1994. Penguin Books, NY.

A lengthy, detailed, very complete but readable analysis of a variety of infectious diseases that are making the news - from HIV/AIDS to Ebola to Hantavirus.

Kolata, G. **Flu - The Story of the Great Influenza Pandemic of 1918 and the Search for the Virus that Caused It**. 2000. Farrar, Straus and Giroux, NY.

A fascinating account of a forgotten pandemic that killed more soldiers during WWI than the war; further, it details current attempts to identify and study the virus that caused the disease.

Shiltz, R. **And The Band Played On**. 1988. Penguin Books, NY.

A detective story of the early years of the AIDS epidemic - how the disease spread, how

the virus was identified, and the attempts to stop its spread. A movie of the same name can be rented at local video stores.

Rhodes, R. **Deadly Feasts**. 1998. Simon and Schuster, NY.

A chilling book that starts by describing a cannibalistic feast in which the prion disease Kuru is potentially transmitted from the dead person to the diners. The book continues by describing other prion diseases, up to and including "mad cow disease." Hard to put down, and hard to eat a hamburger after reading it.

Preston, R. **The Hot Zone**. 1994. Random House, NY.

Beginning with a man on a plane who dies of exsanguinating Ebola, this book continues by describing a "close call" with monkeys near Washington DC who were infected with a related, but airborne, virus.

## Infectious Diseases

# Bacteria

Many different biological agents cause infections. They range from prions, which are tiny bits of protein so small that they are barely visible even with the most powerful microscope, to intestinal parasites that may grow to nearly 50 feet in length! Other pathogens include fungi, viruses and bacteria.

**Bacteria** are small, one-celled organisms that reproduce by dividing: one into two, and those divide into two, and so on. Most are harmless and only a few cause disease. As part of their normal metabolism, bacteria release enzymes and other chemicals. Some of these are toxic and harmful to our cells.



Rod-shaped bacteria swim around in a culture.

The body's immune system fights bacterial disease through the specialized cells. These cells patrol the body, looking for bacteria and other foreign invaders. If they encounter a foreign invader, they will engulf and destroy it.

Bacterial diseases spread by:

- feces (cholera)
- dirt (tetanus)
- droplets (tuberculosis, diphtheria)
- arthropods [fleas] (plague)
- sexual contact (syphilis)
- food (staph food poisoning, botulism)
- contaminated water

## Antibiotics

Bacterial infections are treated with antibiotics. Antibiotics such as penicillin and streptomycin are prepared from fungi, and kill bacteria or prevent them from reproducing. Antibiotics do not kill viruses, such as cold. They are useless in the treatment of viral diseases except to prevent secondary bacterial infections.

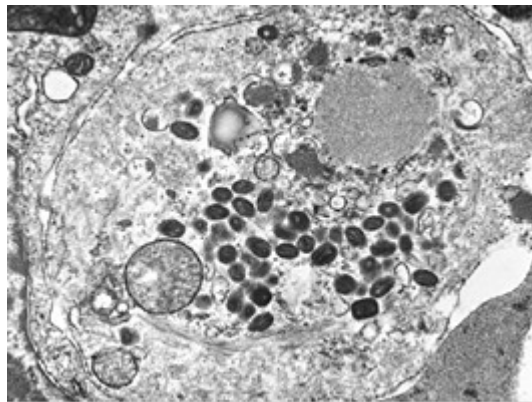
## Infectious Diseases

# Viruses

A virus is a small bit of genetic information (RNA or DNA) surrounded by a protein coat. These tiny agents cannot reproduce on their own but must take over a living cell to replicate.

When a virus enters the body, it immediately begins searching for a host cell, and more specifically, for a particular attachment site on that cell. Once it attaches, it enters or injects its genetic information into the cell. At that point, a coup is underway.

Directed by the genetic material of the virus, the cell turns its attention to the virus's instructions. Those instructions direct the cell to construct new viral particles, and so it does. The cell has been turned, for all practical purposes, into a virus-producing factory.



This cell, the outline of which is lightly visible in this micrograph, is full of dark viral particles.

Here are the different things that can happen when a viral disease is acquired:

- overwhelming infection occurs, and the host (organism) dies
- the virus causes a carrier state
- the virus is destroyed by the immune system

Viruses are spread by:

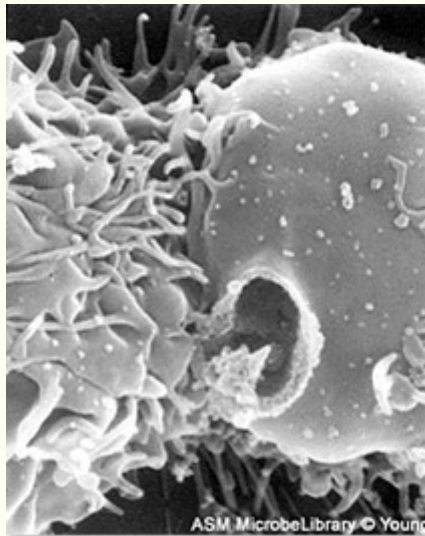
- blood (HIV, Hep B & C)
- droplets or direct contact (cold, flu)
- saliva (rabies)
- feces (Hep A)
- insects (West Nile virus)

## How the Body Fights Viruses

When you are invaded by a virus, your body takes a snapshot of the invader, and translates that snapshot to a "memory" of viral infection. This memory takes the form of small circulating agents called antibodies. If you had chickenpox as a child,

you undoubtedly have chickenpox antibodies circulating in your blood.

If you are exposed to chickenpox at a later time, for example while caring for a patient with chickenpox, your antibodies are ready to go into high gear. If a chickenpox virus makes it into your body, lots of antibodies are manufactured by the immune system; they bind to the virus and prevent it from invading cells. The antibody-virus complex can be easily recognized and destroyed by the immune system.



**The immune cell on the left has identified and is attacking a virus-infected cell. The infected cell is dying; the cell membrane is beginning to disintegrate (note the large hole).**



## Infectious Diseases

# Avian Flu

Avian influenza A – also called the H5N1 virus or bird flu – is very contagious among birds and can quickly kill domesticated chickens, ducks and turkeys. It has been deadly in the few humans who have contracted it from domestic birds. It appears that the H5N1 virus currently does not spread from person to person. But because all influenza viruses have the ability to mutate, scientists are concerned that it could spread easily from one person to another causing a deadly pandemic.

### Transmission

- in very rare cases, the virus has spread to humans through contact with saliva, nasal secretions and feces of infected birds

### Occupational Exposure

- none at this time; the virus could mutate and then spread easily through virus-laden droplets that are expelled during coughing and sneezing

### Prehospital Presentation

- high fever
- cough and sore throat
- muscle aches
- eye infection (conjunctivitis)
- pneumonia
- acute respiratory distress

### Prevention

- because avian influenza viruses do not commonly infect humans, there is little or no immune protection against them

## Infectious Diseases

# Pandemic Flu

A pandemic is an outbreak of a contagious disease that affects an entire population over a wide geographical area. Pandemic flu is caused by an influenza virus to which humans have little or no natural resistance. Such an outbreak has the potential to cause many deaths and illnesses. Past pandemic flu viruses have been known for their virulence causing rapid death, especially in young people.

Although the H5N1 virus probably poses the greatest current pandemic threat, other avian influenza viruses also have the potential to give rise to the next pandemic.

### Pandemic vs. Seasonal Outbreak

Pandemic outbreaks are different from seasonal outbreaks of influenza. Seasonal outbreaks are caused by subtypes of influenza viruses that already circulate among humans. Pandemic outbreaks are caused by new subtypes, subtypes that have never circulated among people or subtypes that have not circulated among people for a long time.

### The 1918-1919 Pandemic

In 1918 to 1919, a pandemic swept the globe. 20 to 40 million people died. Up to a third of the world's population became ill, with the highest mortality suffered by those between 20 and 40 years of age. It wasn't the Black Death, or yellow fever, or cholera, or any number of other horrific diseases that we have come to associate with widespread death and destruction. It was a disease that most of us have experienced in our lifetimes, a disease that resurfaces every year, a disease that we regard casually and even cavalierly. It was the flu.

## Infectious Diseases

# HIV

AIDS is caused by the Human Immunodeficiency Virus (HIV). HIV attacks the cells of the immune system and, as the immune system fails, the person becomes susceptible to “opportunistic” diseases and infections.

### Transmission

- unprotected sex with an infected partner
- infected blood given during a transfusion (extremely rare)
- sharing of needles by IV drug users
- an infected mother to her baby
- occupational transmission usually by a needlestick of infected blood

### Prehospital Presentation

Unlike many diseases, which present in a predictable way, HIV/AIDS varies in its presentation depending on which opportunistic disease or infection is acquired. You may encounter:

- dehydration and hypotension secondary to diarrheal diseases
- seizures or altered mental status secondary to a nervous system infection
- dyspnea secondary to a respiratory infection (pneumonia, tuberculosis, etc.)
- medication reactions
- end of life issues

### Occupational Risk

The occupational risk of acquiring AIDS is VERY LOW.

### Prevention

The CDC statistics support the claim that HIV is transmitted most effectively through blood. Prevention should therefore be focused on preventing significant blood exposures, specifically needlesticks. If a significant exposure does occur, post-exposure prophylaxis may be recommended.

**Infectious Diseases****Hepatitis B**

This disease is caused by the hepatitis B virus (HBV), which damages the liver. Vaccination against HBV has been available since 1982. The disease is spread by contact with the blood of a person infected with the disease, or by sexual transmission.

**Transmission**

- sex with an infected person
- blood and other bodily fluids
- sharing needles with an infected person
- from a woman to her baby during birth

**Prehospital Presentation**

Because most of the signs and symptoms of Hep B are mild, it is unlikely that you will be called to respond to an acute illness caused by this virus. However you may on occasion see a patient with end stage liver cancer or other complications from the disease.

**Occupational Risk**

The occupational risk for acquiring HBV from an unvaccinated person is significant. The risk for a vaccinated person is very low.

**Prevention**

The best way to prevent an occupational exposure to HBV, in addition to taking care to protect yourself from blood exposure, is to be vaccinated against the disease.

## Infectious Diseases

# TB

Tuberculosis (TB) is a disease caused by small bacteria that travels from the small airways to the cells of the lungs. Less than 10% of people infected with TB will develop active disease; in the others, the bacteria hides, causing no disease until the host (patient) becomes immunocompromised or otherwise debilitated.

### Transmission

- via small airborne particles expelled by cough, sneezing, or speaking
- particles are inhaled into small airways
- prolonged exposure in confined space confers highest risk

### Prehospital Presentation

A person with active disease may have the following signs and symptoms:

- cough, often productive of blood-tinged sputum
- fatigue and weakness
- night sweats
- low-grade fever
- loss of appetite and weight loss

### Occupational Risk

Occupational risk is low but has been very difficult to quantify.

### Prevention

You can minimize your chance of acquiring TB by maintaining a high index of suspicion among patients who are at risk of having TB, and then taking precautions if patients present with suspicious signs and symptoms.

## Infectious Diseases

# SARS

In February 2003, a new and virulent respiratory infection was reported in Asia. Over the next few months, before effective steps could be taken to contain the disease, it had spread to over 20 countries through North America, South America, Europe, and Asia – a testament to the effect of global commerce, enterprise and travel.

The SARS outbreak of 2003 was contained by the summer. However before it disappeared, it sickened over 8,000 people worldwide, of who 700 died. In the United States, there were 192 possible cases (of these, only 33 were considered "probable"), and there were no deaths. However, worldwide, the disease was unusual and frightening in that it had a relatively high case fatality rate among young, healthy people.

### Transmission

Droplets spewed from the cough or sneeze of an infected person:

- close person-to-person contact
- touching an object and then touching the mouth, nose or eyes

### Prehospital Presentation

- fever, headache
- malaise, body aches and diarrhea
- cough and possible respiratory symptoms
- most patients develop pneumonia and may require ventilatory assistance and supplemental oxygen

### Occupational Risk

Currently minimal risk due to lack of recent cases – follow local and CDC guidelines for identification of high-risk patients if the disease returns.

### Prevention

Use standard precautions: wash hands, wash surfaces and use contact precautions: gown, gloves, and protective eyewear.

### Information about SARS

SARS is caused by a coronavirus. This family of viruses has also been implicated in the common cold (note: there are multiple causes of the "common cold"). It is possible that the coronavirus causing SARS has a reservoir in animals. A virus appearing identical to human SARS has recently been discovered in the civet, a small carnivore related to the mongoose. The civet is a culinary delicacy in parts of Asia and thousands are kept in captivity prior to being eaten.

Treatment is largely supportive and symptomatic, and is similar to the treatment that would be given to a person with serious pneumonia. Antiviral drugs were tested

but were not found to be very effective.

We can't predict if or when SARS will return, whether it will make its way to North America, and if it does, what form the disease will take. Epidemiologists will be continuing to monitor the global disease situation.

**Infectious Diseases****Influenza**

The flu, more commonly known as influenza, is caused by the influenza virus, which attacks the respiratory system. Flu occurs seasonally, generally from November to April in the northern hemisphere. The structure of the virus changes slightly but frequently over time; this accounts for the appearance of different strains each year.

The natural reservoir of Type A influenza (the strain that has the potential to cause pandemics) is wild birds, but the virus can also affect pigs and horses. The virus can mutate in these hosts. In the 1918-1919 flu pandemic, the strain was unusually virulent – not only was it very infectious but it also had a high mortality rate. That event is considered to have been the worst epidemic in recorded history, and is the main reason that we should not underestimate the flu.

**Transmission**

- coughed droplets
- touching contaminated surfaces (less common)

**Prehospital Presentation**

Sudden onset of:

- high fever
- malaise
- headache
- dry cough
- body aches

**Occupational Risk**

Occupational risk varies.

**Prevention**

- Hand washing, clean surfaces
- Place mask on patient or ask patient to cover mouth when coughing
- Best prevention is the flu vaccine, which must be taken yearly



## Infectious Diseases

# Noroviruses

The Norwalk virus is a highly contagious virus responsible for outbreaks of gastrointestinal disease on cruise ships. Norovirus is the general name given to viruses of this type. In fact, noroviruses are responsible for many cases of severe but short-lived illnesses causing vomiting, diarrhea, and stomach cramps. If you have ever had a "stomach flu" or "food poisoning," it is likely that you were infected with a norovirus.

### Transmission

Transmission of noroviruses occurs via the fecal-oral route. For example, a food handler does not wash his hands after using the bathroom; you then ingest food that has been contaminated with small amounts of fecal matter.

A person with a norovirus is considered contagious from the time he or she starts feeling ill to as long as two weeks after recovery.

### Prehospital Presentation

- nausea and vomiting
- diarrhea
- stomach cramps
- low-grade, transient fever (less than half of cases)
- general feeling of malaise, headache, body aches

These symptoms begin suddenly, may last one to three days, and usually resolve on their own. Because the disease is caused by a virus, antibiotics are useless.

### Occupational Risk

Most cases of noroviruses are community-acquired, usually in situations where large numbers of people share the same food or living space (cruise ships, college dorms). However there have been several outbreaks of noroviruses among staff at hospitals and nursing homes.

### Prevention

Norovirus is highly contagious. The virus spreads through infected feces or vomit that is accidentally ingested. While there is no evidence of infection via the respiratory route, it is possible for small droplets of vomitus to become aerosolized and come in contact with the mucous membranes.

Therefore, if you treat a person with vomiting and diarrhea, wear gloves, wash your hands thoroughly, and consider the use of protective eyewear and mask. In addition, surfaces contacted by the patient must be thoroughly disinfected.

If you become sick, wait two days after the last of your symptoms before returning to work.

**Infectious Diseases****West Nile Virus**

West Nile disease was first identified in Africa in the 1930s, and gradually spread across Asia and Europe before arriving on the west coast of the US in 2002. The virus causing the disease, West Nile Virus (WNV), infects certain types of birds (ravens, crows, jays), mosquitoes, horses, and other animals. Humans are an incidental, rather than primary, host.

**Transmission**

- WNV is transmitted through the bite of an infected mosquito.
- WNV is NOT transmitted person-to-person except in the rare case of a blood transfusion from an infected person.

**Prehospital Presentation**

Most people (about 80%) who are infected with WNV have a sub-clinical infection—they may not even know they are infected because they do not feel sick, although studies of their blood will show evidence of the infection. About 20% of people infected with WNV will have mild, self-limiting symptoms such as:

- fever
- headache
- fatigue
- rarely, a rash and swollen lymph nodes

Less than 1% of the people infected with WNV will develop severe illness, usually a meningitis or encephalitis. These people may present with high fever, headache or altered LOC possibly culminating in coma.

It is important to place this information in perspective. Even in states reporting cases of WNV, the disease is extremely rare compared to other causes of encephalitis and meningitis.

**Occupational Risk**

- There is no occupational risk involved in caring for a person with WNV disease.

**Prevention**

- Since WNV disease is not transmitted person-to-person, no specific disease prevention precautions are necessary at work.

## Infectious Diseases

# Risk

It is worth noting that the attention given to a disease in the popular press may be distinctly out of proportion to the risk it presents to you as an EMS provider. An early example of this was the AIDS epidemic. In the last 25 years, an estimated 57 health care workers in the United States have contracted HIV from a documented occupational exposure.

Yet, in spite of this relatively low risk, we take many precautions to protect ourselves from this virus. It is ironic, that prior to the development of the Hepatitis B vaccine, thousands of health care workers EVERY YEAR contracted Hepatitis B from an occupational exposure, and it is estimated that as many as 200 per year died!

It was known that Hepatitis B was a blood borne disease, yet in spite of this knowledge, widespread glove use and other precautions against blood borne diseases did not occur until HIV came on the scene.

### **Why is an assessment of risk important to an EMS Provider?**

Viewing EVERYTHING as equally risky blunts our appreciation for those things that are truly dangerous. For example, many health care providers wear gloves at all times, and go to great lengths to avoid getting blood on their skin. Yet blood on intact skin poses a vanishingly small risk, compared to the hazard of getting a needlestick (.3% or 1 in 300).

## Infectious Diseases

# Gloves

Wear gloves for contact with blood or other bodily fluids. Recognize that most bodily fluids, such as vomit or urine, while aesthetically unappealing, do not typically carry blood borne viruses. Others, such as feces, may harbor bacteria or parasites that could make you sick. These are not transmitted through the skin or via inhalation, but through the so-called fecal-oral route.

Therefore...wash your hands!



The use of gloves actually *increases* the incidence of bacteria on your hands, since it provides a warm, protected environment for these pathogens. Wash your hands after all patient contact, even if you wore gloves.

Gloves are for use during patient contact. Remove gloves when you are done with patient contact, before getting into your rig, talking on the radio or driving. This will reduce the chances of contaminating other items.

**Infectious Diseases****Goggles/Masks**

Wear goggles and a mask if there is a splash potential of blood, vomit, or other fluids. While the chance of contracting a blood borne disease through this route is very remote, this is a reasonable precaution to take in a situation where there is a splash potential.

If you suspect an airborne disease such as tuberculosis, put a mask on the patient (if tolerated), and wear a mask yourself. HEPA masks, as provided by your department, provide the highest level of protection.

## Infectious Diseases

# Sharps

**Be exceedingly careful around needles!** Needlesticks represent by far the greatest risk of occupational blood borne transmission.

You may be occasionally expected to handle sharps such as scalpels in an OB kit, epi-pens, needles, and lancets for glucometry.

You should NOT be asked to handle sharps or manipulate sharps if you were not trained to do so (for example, transferring blood to blood tubes).

Many "exposures" among EMS providers involve cases in which EMS providers inadvertently stuck themselves with used needles!

Therefore...be CAUTIOUS, be AWARE, and be DELIBERATE, when you are working around sharps. Keep an eye on the paramedics and needles, and watch where you put your hands.

## Infectious Diseases

# Needlestick

For needlestick exposures, wash the area well with soap and water. Do NOT use bleach or other harsh chemicals. These may damage the skin, making it more likely for the virus to enter the body.

Report the exposure immediately to your officer for testing and possible post-exposure prophylaxis (see your department's guidelines).

**Infectious Diseases****Skin/Mucus****For exposures to non-intact skin you should:**

- wash with soap and water
- report the exposure immediately to your officer for testing and possible post-exposure prophylaxis (see your department's guidelines)

Blood on intact skin is not considered a significant exposure. Non-intact skin includes abrasions and cuts.

**For exposures to mucus membranes you should:**

- flush liberally with water
- report the exposure immediately to your officer for testing and possible post-exposure prophylaxis (see your department's guidelines)



**Infectious Diseases****Airborne**

For airborne exposures, report possible exposure to your company officer. In some cases the hospital may notify exposed responders if the patient is diagnosed with an airborne disease (e.g., TB or bacterial meningitis).

Some diseases (bacterial meningitis) may require automatic and immediate post-exposure prophylaxis, while others (tuberculosis) may require post-exposure testing and then treatment only if you become positive.

## Infectious Diseases

# PEP for HIV

Any possible exposure to a blood borne disease must be reported immediately to your company officer. Your department's SOPs will give guidance which may include taking post-exposure prophylaxis.

A health care worker who has a significant exposure to HIV may take "post-exposure prophylaxis" (PEP)—medications that are taken AFTER an exposure to reduce the chance of acquiring the disease. Post-exposure prophylaxis reduces the already very low risk of acquiring the disease, although it does not guarantee that no disease transmission will occur.

The medications taken for PEP are TOXIC. Most people who take them experience significant side effects ranging from fatigue to nausea and vomiting; in fact, as many as 30% of health care workers who start PEP stop taking the drugs because of the side effects. PEP also carries with it a chance of serious permanent consequences such as liver damage. This is not a decision to be taken lightly!

If PEP is started, it should be **started SOON!** Animal studies suggest that PEP is most effective if started IMMEDIATELY after exposure, if at all possible within two hours.

Part of the plan for PEP includes testing of the source blood. If the patient is determined to be HIV-negative, the PEP medications can be stopped.

## Infectious Disease

# Summary

As part of their normal metabolism, **bacteria** release enzymes and other chemicals that can be harmful to the cells of the body.

A **virus** cannot reproduce on its own but must take over a living cell to replicate.

The **occupational risk** of acquiring AIDS is VERY LOW.

The best way to prevent an **occupational exposure to HBV**, in addition to taking care to protect yourself from blood exposure, is to be vaccinated.

**Remove gloves** when you are done with patient contact, before getting into your rig, talking on the radio or driving.

If you suspect TB, **put a mask on the patient** (if tolerated), and wear a mask yourself.

**Needlesticks** represent by far the greatest risk of occupational blood borne transmission.

If PEP is to be started, it should be **started** IMMEDIATELY after exposure, if at all possible within two hours.